

# A Description of a New Species of *Dirona* from the North-East Pacific

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(Plate 2; 7 Text figures)

## INTRODUCTION

THE FAMILY DIRONIDAE was first described by COCKERELL & ELIOT (1905) and later by MACFARLAND (1912) giving a full account of two new species, *Dirona picta* MACFARLAND in COCKERELL & ELIOT, 1905 and *D. albolineata* MACFARLAND, 1912. Two more species have been added to the family: *D. pellucida* by VOLODCHENKO (1941) and *D. akkeshiensis* by BABA (1957), the latter species having been tentatively called *D. albolineata* in an earlier publication (BABA, 1935). A further note on *D. picta* has been made by VOLODCHENKO (1955) and additional information on this species and on *D. albolineata* has been provided by MARCUS (1961). A new species from the Puget Sound area possesses all the characters outlined for the family Dironidae and the genus *Dirona* but is clearly different from the previously established species in the following respects: general coloration, distribution of white markings, morphology of the egg mass, veligers, cerata, reproductive system (particularly the penis), size and proportions of radular teeth. It does not interbreed with the other local species, *D. albolineata*.

### *Dirona aurantia* HURST, spec. nov.

The type specimens were collected by dredge between 11 and 30 fathoms west of Blakely Island and in West Sound in the vicinity of Friday Harbor Laboratories. *Dirona aurantia* has been previously dredged in the region at similar depths and one was observed on a float near the shore. Specimens have been most numerous in the winter months (September onwards) and have laid eggs in aquaria in January, February and March. They have sometimes been dredged with *D. albolineata* but in aquaria the two species do not associate and lay dissimilar egg masses (that of *D. albolineata* was described by O'DONOGHUE & O'DONOGHUE, 1922) giving rise to readily distinguishable veligers.

(It is intended to discuss further the eggs and veligers of these species in a later publication.) The narrow pink egg string of *D. aurantia* is laid in a loose coil, part of which appears in Plate 2, Figure 4.

The range of food taken by *Dirona aurantia* is wide. In one animal some apparent vegetable matter was found, in others were remains of hydroids and bryozoans, another's stomach was crammed with gammarids and caprellids, several being longer, though narrower, than the buccal region of the gut. It is likely that these crustaceans were eaten as dead or dying matter. *Dirona aurantia* lives well scavenging in aquaria. Unhealthy and dead specimens may be found with the buccal region protruded as described by COCKERELL & ELIOT (1905) in *D. picta*. This is an unnatural phenomenon: the feeding apparatus is such that it could not be effectively used in this position unlike that of some other opisthobranchs (HURST, 1965).

**Size:** Specimens have ranged in length from 3 to 12 cm. In an animal 7 cm long, the foot measured 6 cm and the oral veil 1 cm, the latter being wider than the foot (Plate 2, Figure 3). Thus *Dirona aurantia* may be longer than the greatest size recorded for other dironids (COCKERELL & ELIOT, 1905, MACFARLAND, 1912); however *D. albolineata* up to 12 cm has also been collected locally so that the length of 4.2 cm quoted for it by MACFARLAND (1912) is not maximal.

**Color:** The ground color is orange throughout (Plate 2, Figures 1, 2, 3, 4). Some specimens have occurred which were of a deeper reddish orange than those photographed here, but none were lighter. The body is scattered with white, granular spots (Figure 1, gr) though none appear on the underside of the foot or oral veil (Plate 2, Figure 3). A few isolated specks occur on individual cerata but here almost all the granules are concentrated in a tapering white line (Figures 1, 2, ce, gr), extending from a short distance above the ceratal base, up the median side and

surrounding the translucent tip completely. White granules are absent or scarce on the rhinophores (Figure 1, rh). The radiating white lines on the cerata are prominent in the living animal (Plate 2, Figures 1, 2, 4). The viscera may be seen by transparency through the underside of the foot as a dark brown mass (Plate 2, Figure 3).

**General appearance:** The animal is limaciform with a broad foot, rounded anteriorly and tapering posteriorly to a bluntly pointed tail (that part of the foot posterior to the bases of all cerata) which has a distinguishable dorsal ridge. This ridge is always white in *Dirona albolineata* but not in *D. aurantia*. The head is bluntly rounded (Figure 1) and around its anterior margin is the oral veil (or). This veil is thin, with very undulating edges, usually curving upwards medially (Plate 2, Figures 1, 3, 4). The mouth is a longitudinal slit mid-ventrally placed at the base of the oral veil (Plate 2, Figure 3).

The rhinophores (Figure 1, rh) point forwards and outwards at angles of about 120° with the back and with each other. The lower half of each rhinophore is stout and a little wider than the perfoliate terminal part. The

extreme tip is blunt and the rhinophore leaves are fairly regular and oblique, sloping forward and up from a mid-dorsal posterior separation. There are usually a few more than 20 leaves.

The cerata (Figures 1, 2, ce) are very numerous except in unhealthy specimens, in which they readily drop off (although they may be quickly regenerated). They are

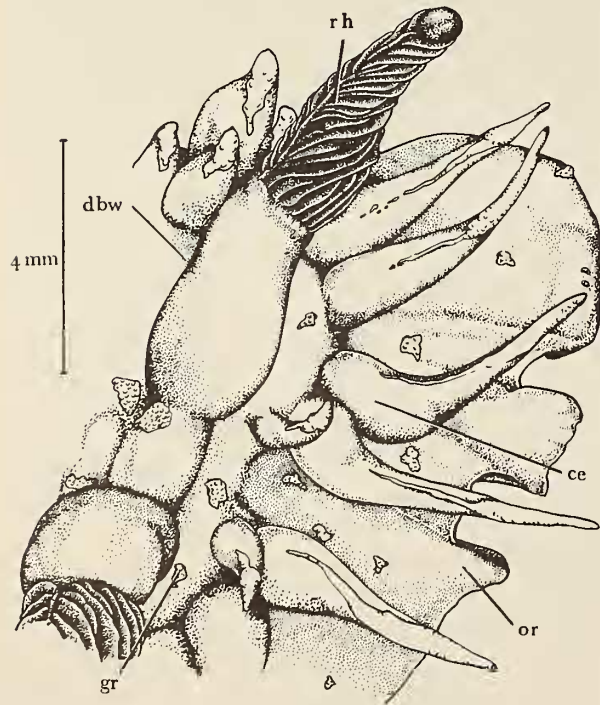


Figure 1

Right antero-dorsal view of the head region of *Dirona aurantia*.  
 ce - ceras      dbw - dorsal body wall      gr - granules  
 or - oral veil      rh - rhinophore

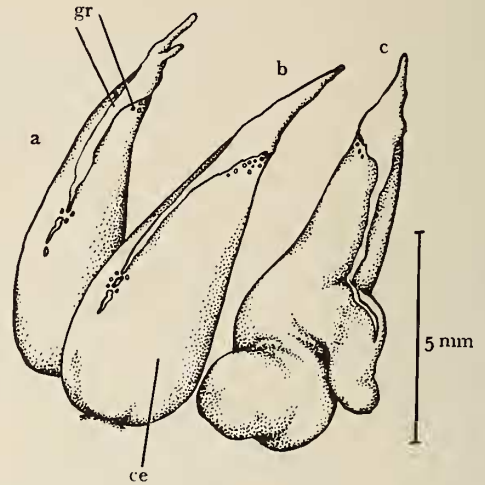


Figure 2

Median postero-lateral view of three cerata (a, b, c) of the right side of *Dirona aurantia*.

ce - ceras      gr - granules

based in a continuous series (but for a median anterior gap between the rhinophores) from anterior to the rhinophores along the sides and meeting over the dorsum at the base of the tail. The outermost cerata are abundant and very small. Median to them the cerata are larger and fewer, slightly flattened antero-posteriorly (less markedly than in *Dirona albolineata*) and much swollen above the narrow base. The largest occur on the posterior half of the body and often obscure this region of the back (Plate 2, Figure 2). Sometimes a few small cerata occur amongst the innermost cerata, unlike *D. picta* and *D. albolineata* (MacFarland, 1912). They are probably regenerating after the loss of some large cerata. A few cerata may be bifid (Figure 2, a) and some (rarely) are bluntly branched or very irregularly swollen (Figure 2c). All are smooth and muscular, continuing to contract vigorously when detached.

The reproductive openings lie about ¼ of the way back from the head, on the right side below the cerata. The female opening is surrounded by radiating folds and is



Figure 1



Figure 3

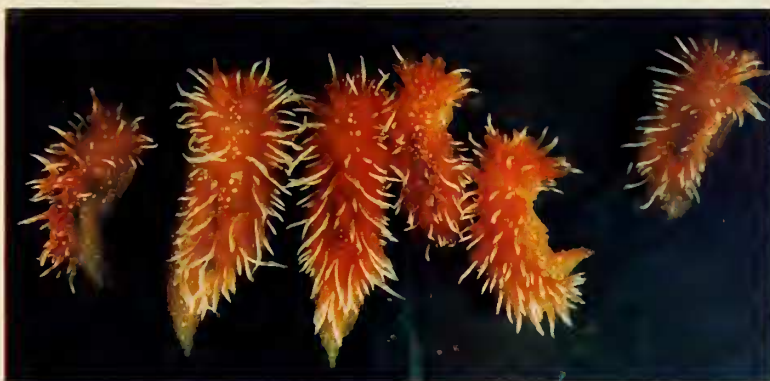


Figure 2

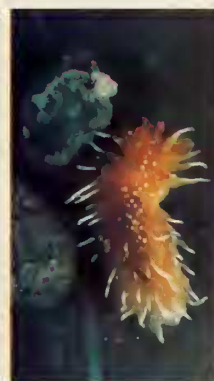


Figure 4

Figure 1: *Dirona aurantia* HURST. Dorsal view of holotype.

Figure 2: Collection of six *Dirona aurantia* HURST from off Blakely Island and from West Sound.

Figure 3: *Dirona aurantia* HURST, ventral view.

Figure 4: *Dirona aurantia* HURST and part of its egg mass.

The parent was disturbed when only a small part of the mass was laid.



stretched widely during egg laying. Halfway along the right side immediately below the outermost cerata is the small renal aperture. The anus, as in other dironids, is raised on a stout papilla amongst the most posterior cerata of the right side. The papilla is cylindrical with longitudinal folds allowing considerable expansion during passage of faeces.

**Internal anatomy:** The mandibles (Figure 3) are large, completely enclosing the sides of the buccal region of the gut (Figures 3, 7, wj), closely hinged anteriorly (aj, al).

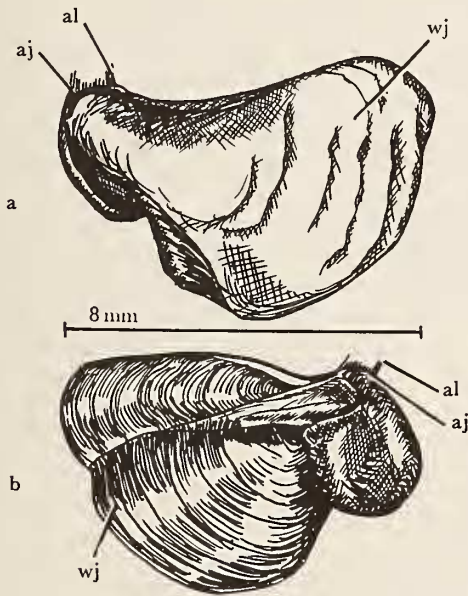


Figure 3

Left mandible of *Dirona aurantia* in

- a) outer lateral view
- b) median lateral view
- aj - articular region of jaw
- al - articular ligament of jaw
- wj - lateral wing of jaw

They are very stout and of similar form to those of *Dirona picta* and *D. albolineata* described and drawn by MACFARLAND (1912). In all dironids the jaws serve as an important area for attachment of muscles concerned in the feeding process.

The radula from which Figure 4 was drawn has the formula 2·1·2x24-26. Some specimens have less rows of functional teeth, the minimum observed being 2·1·2x12-15. As in other dironids the short horizontal radular sac lies dorsally, above the bulk of the buccal mass. That part of the radular membrane bearing functional teeth curves down anteriorly and is folded longitudinally forming a

deep groove at the base of which are the median teeth (Figure 4, mt). They are widely separated from the rows of lateral teeth (1lt, 2lt) situated at the upper edges of

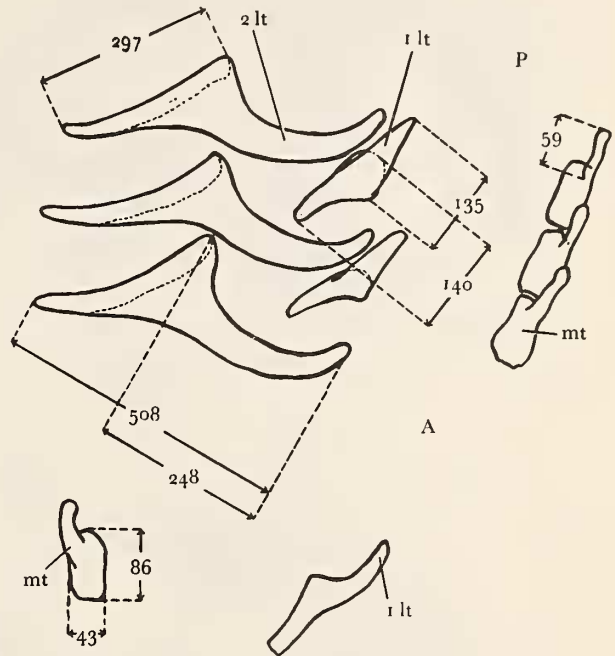


Figure 4

Radular teeth of *Dirona aurantia*.

- A - anterior
- 1lt - first lateral tooth
- 2lt - second lateral tooth
- mt - median tooth
- P - posterior

the groove where the radular membrane is reflected over the buccal mass. The teeth are larger than their counterparts in *Dirona picta* and *D. albolineata*, measured by MACFARLAND (1912) and MARCUS (1961), but as MARCUS noted tooth size varies with that of the whole animal. The form of the teeth is similar to that of other dironids. Each median tooth (mt) has a peg-like, back-pointing spine arising from a roughly rectangular base. Each first lateral tooth (1lt) has a simple spine pointing medially and backwards, converging at its tip with that of the adjacent second lateral tooth (2lt) of the same row. The large second lateral tooth is flattened and hamate, bluntly pointed and curves slightly backwards towards the median line.

The penis (Figures 5A, 6, pe) is large and wide except at the tip which narrows abruptly to a short smooth papilla (pp). It is readily distinguishable from those of

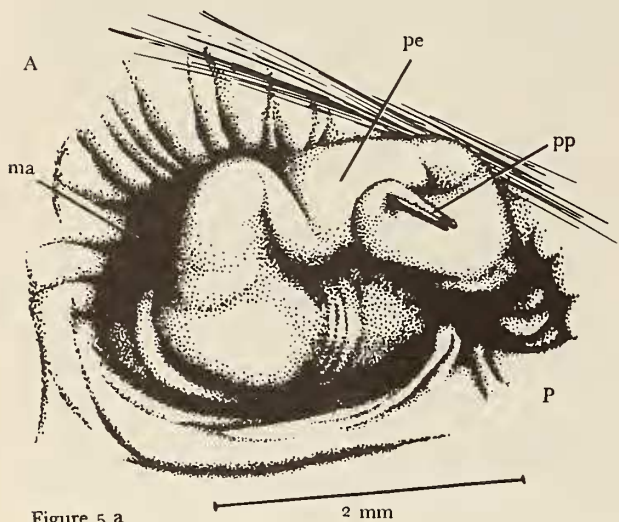


Figure 5 a

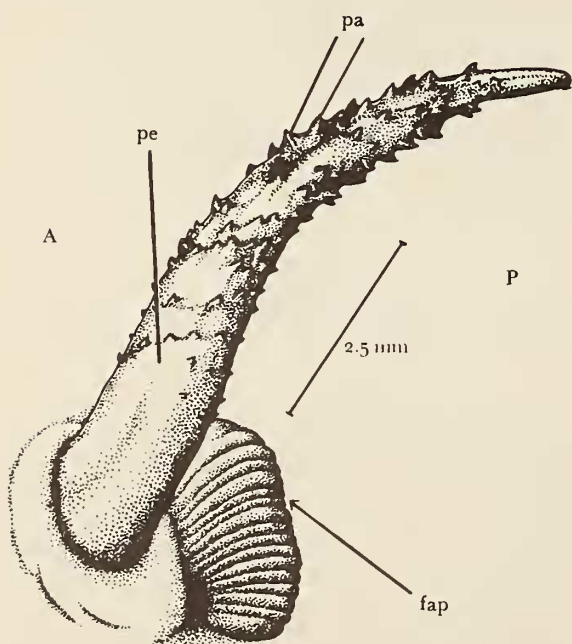


Figure 5 b

Figure 5

Penis of

- a) *Dirona aurantia* (retracted)     b) *Dirona albolineata* (extended)  
 A - anterior     P - posterior  
 fap - female aperture     ma - male atrium  
 pa - penial armature     pe - penis     pp - penial papilla

*Dirona picta* drawn by MARCUS (1961), *D. akkeshiensis* drawn by BABA (1935) and *D. albolineata* (Figure 5 B, pe). The reproductive tract (Figure 6) is of essentially the same plan as that of these two species as described by MACFARLAND (1912) and further by MARCUS (1961). The spermatheca (Figure 6, sp) is large, its duct continuous with the very large muscular female atrium (fa). The oviduct (ov) is narrow and short, closely applied to the female gland mass (fg) and joining the wide terminal part of the hermaphrodite duct (hd). The long coiled vas deferens (vd) is stout but narrow and passes between the fibres of the penial retractor muscle (Figures 6, 7, pr) before entering the penis (Figures 5 A, 6, pe). The penial retractor (Figures 6, 7, pr) passes anterior to the digestive gland (Figure 7, dg) to its origin on the left side of the body wall (bw). Its insertion on the muscular male atrium (Figures 5 A, 6, ma) lies among the muscle fibres (Figure 6, am) surrounding the genital region (Figure 7, ge) of the body wall (bw).

The nervous and digestive systems (Figure 7) are rather similar in disposition to those of *Dirona picta*, described by MACFARLAND (1912). The destinations of the nerves are almost identical and apart from cerebral nerves 5 (Figure 7, c5), their paths are alike. In *D. picta* cerebral nerve 5, the optic nerve, "is closely attached to the anterior margin of c6 (or pl. 1)" (MACFARLAND) but in all specimens of *D. aurantia* examined, this was only true of the nerves of the right side, while on the left side the optic nerve (c5) was separate for its entire length. Pleural nerve 1 (pl 1), as noted by MACFARLAND in *D. picta*, may have a cerebral origin. The ganglia lie very close to the dorsal body wall. The thin-walled oesophagus (oe) is usually flattened on top of the buccal region of the gut as in Figure 7, passing back shortly to the stomach (st) on the left side of the body. The buccal ganglia lie below it, concealed in Figure 7. The buccal nerves are similar in distribution to those of *D. picta* figured by MACFARLAND.

The collection of specimens of *Dirona aurantia* from which the above description is taken is deposited at the California Academy of Sciences, Invertebrate Zoology Type Series, Holotype no. 273.

Geographical locations in Puget Sound from which specimens were taken:

W. Blakely	16 - 18 fathoms	48° 33' N	122° 49.9' W
W. Blakely	30 - 23 fathoms	48° 34.5' N	122° 50.6' W
West Sound	22 fathoms	48° 36.1' N	122° 57.9' W
Broken Point	11 - 12 fathoms	48° 35.4' N	122° 57.4' W

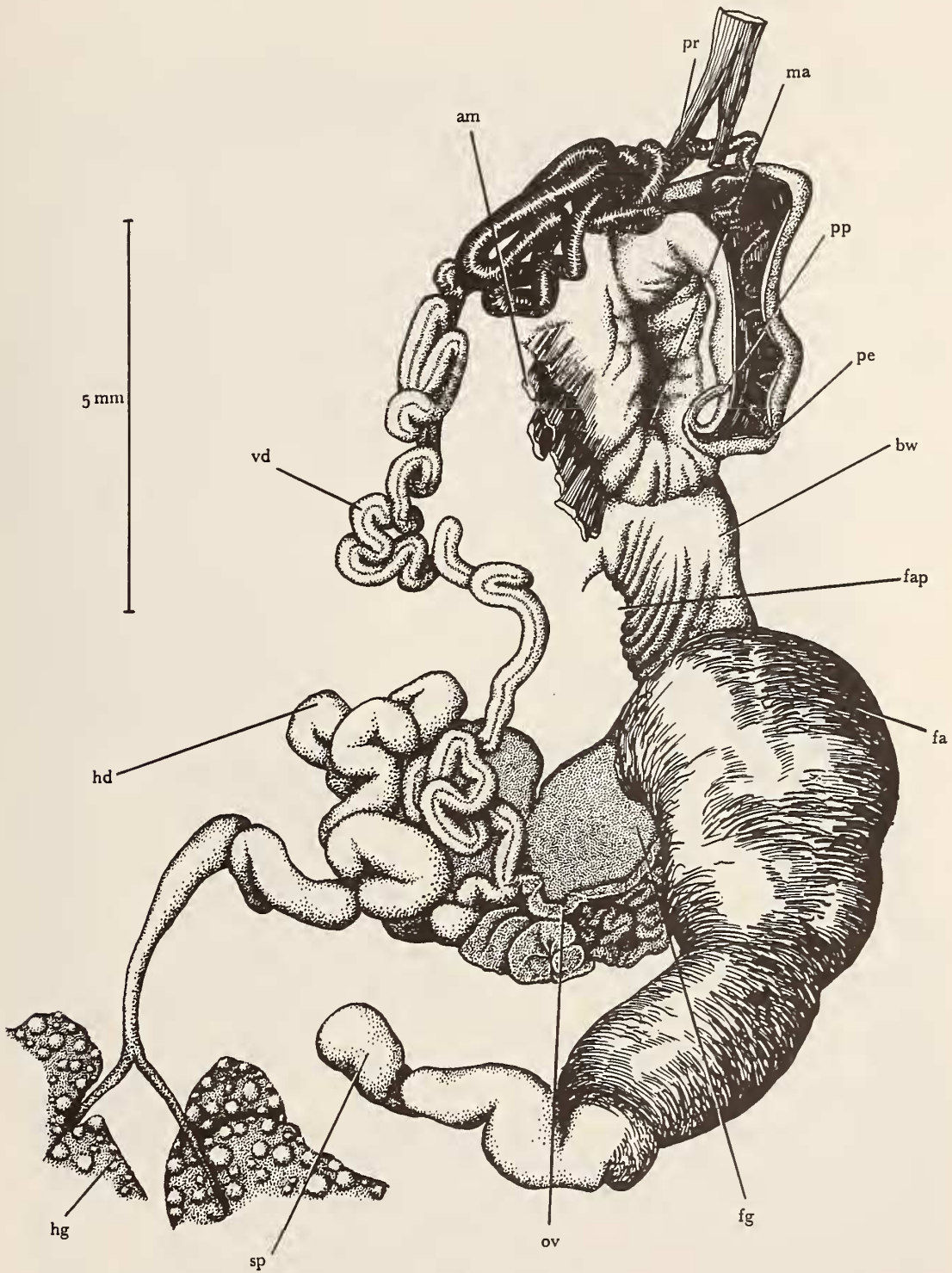


Figure 6

Dissection of the reproductive system of *Dirona aurantia*:  
 penis opened by a longitudinal cut; only part of the hermaphrodite gland shown.

am - atrial muscles  
 bw - body wall  
 fa - female atrium

fap - female aperture  
 fg - female gland  
 hd - hermaphrodite duct  
 sp - spermatheca

hg - hermaphrodite gland  
 ma - male atrium  
 ov - oviduct  
 vd - vas deferens

pe - penis  
 pp - penial papilla  
 pr - penial retractor